



WORKING PAPER

**FIRST UNASSIGNED HIGH SEAS AIRSPACE SPECIAL
COORDINATION MEETING (SCM/1)**

Lima, Peru, 22 to 24 July 2019

- Agenda Item 3: Determination of services and facilities**
3a. Airspace user outline
3b. Potential solutions

UNASSIGNED HIGH SEAS AIRSPACE

(Presented by Ecuador)

SUMMARY

This working paper presents the technical proposal of Ecuador in support of the request submitted to ICAO in October 2017 to be awarded the provision of air navigation services (ANS) in the unassigned high seas airspace located in the South Pacific, west of the Galapagos Archipelago, Insular Territory of Ecuador.

1. Background

1.1 The SAM Region is noted for its progress in the implementation of PBN and the improvement of CNS/ATM and ATFM services.

1.2 Ecuador has developed national civil aviation plans in line with the Global Air Navigation Plan (GANP), as well as national objectives designed to meet ICAO Strategic Objectives, and technical products derived from these, such as the establishment of PBN (performance-based navigation) routes, RNP, GNSS and other technical operational aspects that have allowed for an integrated, harmonised airspace with the highest safety level.

1.3 In developing its connectivity, Ecuador took a very significant step with **UN789 Oceanic Airway**, designed and developed in close coordination with ICAO. Once it was approved, it expedited the evolution of connectivity between two regions such as the SAM and APAC Regions, making it possible to provide flight information in the unassigned FIR, as described in detail in the working paper of SCM/1 presented by Ecuador.

1.4 Ecuador has made significant investments in CNS/ATM and SAR technology to keep up with technological evolution and air navigation capabilities of modern aircraft, and dynamic airspaces like

PBN, RVSM, RNP GNSS and others that provide effective safety oversight support to continental and insular (Galapagos Islands) areas, including oceanic routes.

1.5 The representation of Ecuador to ICAO, working together with the Air Navigation Bureau (ANB), the Air Navigation Commission (ANC) and the ICAO South American (SAM) Regional Office, and subsequent to the aforementioned 36th Session of the Assembly, developed a roadmap with specific objectives for RNP, RNAV optimisation, APAC-SAM connectivity, and management of the “unassigned” flight information region. This would allow for a comprehensive development of global air navigation, furthering safety, connectivity, aviation growth, and economic development of the States.

1.6 Ecuador developed a roadmap for obtaining the unassigned FIR, whose objectives are detailed in the working paper presented by Ecuador, which were fully met and permit the pursuit of objectives 4 and 5 currently under implementation, namely:

- a) modernization and increase of the Continental and Insular SAR capacity of Ecuador; and
- b) Provision and optimisation of the country's CNS capabilities, focusing on connectivity through new RNAV/RNP and oceanic routes, ADS-B technology, and management of the unassigned FIR in the South Pacific.

1.7 At the nineteenth workshop/meeting of the SAM Implementation Group, held in Lima, Peru, from 22 to 26 April 2017, IATA presented a working paper prepared by LATAM Airlines proposing the creation of a route crossing the unassigned airspace close to the Galapagos Islands, Guayaquil FIR. The route is shown in the following graphic: UPR (User Preferred Routes)

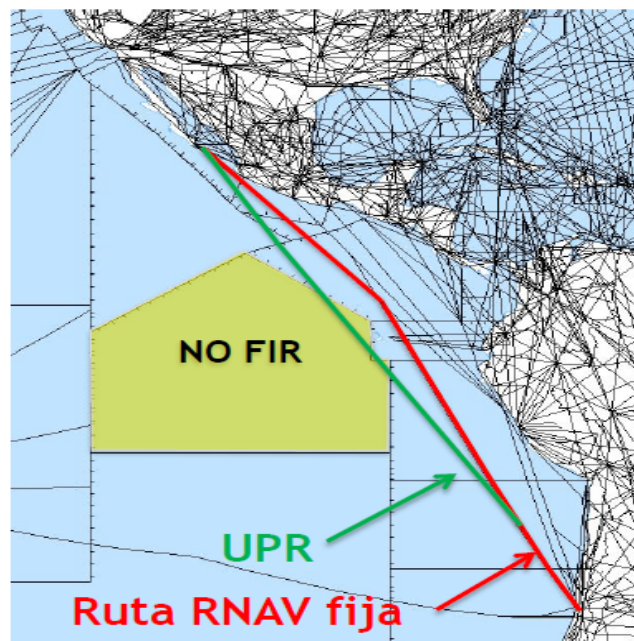
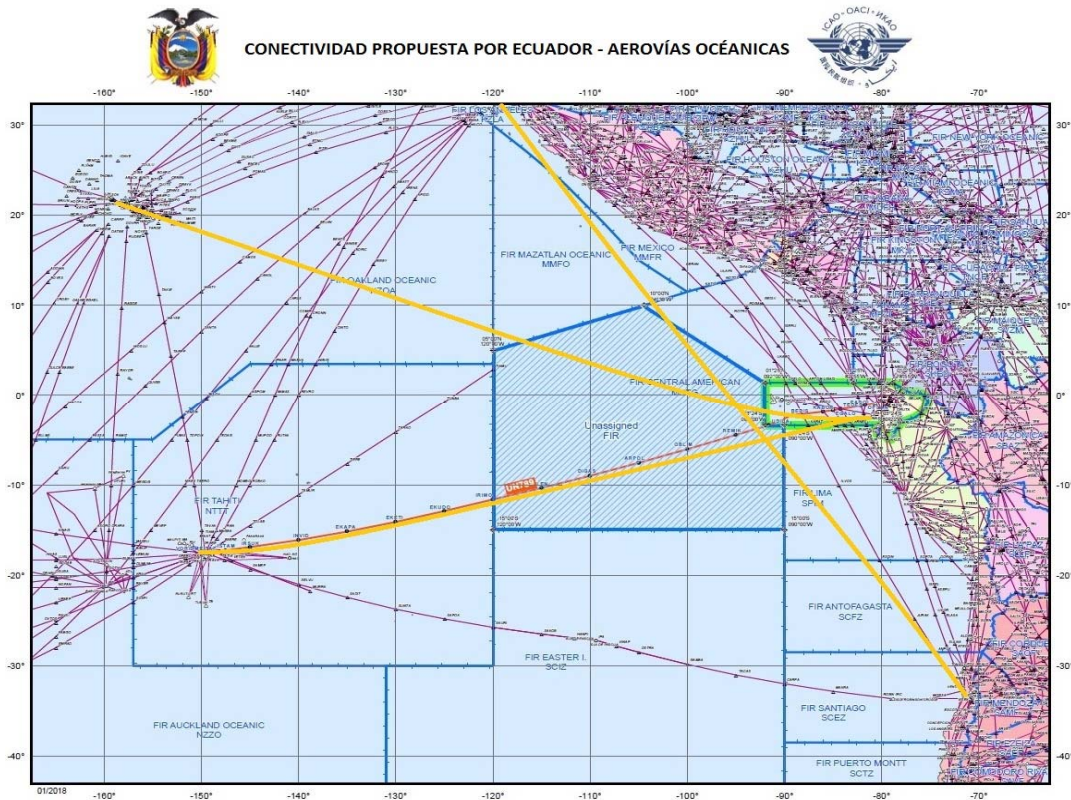


Figure 1: Current route and required direct route

1.8 In addition to that stated above, the Ecuadorian civil aviation authority wishes to submit a proposal for the creation of three oceanic routes in addition to UN7789, which would cross the unassigned FIR at North-South connectivity points. These routes would be as follows:

- a) Route 1: Hawaii-Guayaquil
- b) Route 2: Los Angeles-Santiago de Chile, confirming IATA’s proposal
- c) Route 3: Guayaquil – Tahiti (SEGU-Checkpoint DIGAS, or corresponding on airway UN789)



1.9 In the following sections, this working paper presents the technical and operational capabilities already implemented and in process of implementation by Ecuador, which provide technical options in a definite solution for the assignment of the unassigned airspace.

1.10 The following figure shows the unassigned high seas airspace, taking into account the boundaries of FIRs of the SAM, NACC and APAC regions.



Figure 2: Unassigned high seas airspace

1.11 Regarding uncontrolled airspace, it is important to note that the unassigned FIR is very close to the Galapagos Islands (SEGS), reason why the distances to the farthest points from this Ecuadorian territory are as follows:

- SEGS-South point (15S-90W) – 844 NM
- SEGS-South east point (15S-120W) – 2,004 NM
- SEGS-North east point (5N-120W) – 1,870 NM
- SEGS-North point (10N-104.5W) – 1,115 NM

1.12 The distance from the Islands to the farthest point is of 2,000 NM. This significantly facilitates the provision of services to air operations, considering the technological facilities currently available to air navigation service providers.

1.13 The current technological facilities adequately support the fundamental requirements for the provision of air navigation services in the unassigned airspace. The design and configuration of these services are mainly based on the 2016-2030 Global Air Navigation Plan / ASBU, and have been taken into account for their implementation starting in 2020.

1.14 Ecuador perceives the potential use of this airspace by airlines that are already expressing their interest in establishing more favourable routes, with the resulting reduction in fuel consumption and CO2 emissions. The allocation of this airspace will also create the capabilities for air traffic growth in the Oceania-South America and Oceania-Central America and Caribbean corridors. The strategic position of Ecuador between these two areas enable it to centralise air navigation operations of the Oceanic FIR.

2. Analysis

OPERATIONAL ENVIRONMENT – FIR

2.1 It is important to highlight that Ecuador has a USOAP effective implementation indicator of 90.25%, which becomes the basis for operational quality in the provision of air navigation services in the country and in the airspace under its responsibility.

2.2 The Directorate General of Civil Aviation also has an SSP as a general operational guide and implemented the SMS in the air navigation service process 10 years ago, in support of the SSP.

2.3 There is no data to define the safety level in the NO FIR area with Ecuador as air navigation services provider (ANSP). However, for this purpose, the "ICAO Safety Report, 2018 Edition" is used as a reference, which indicates that the accident rate per one million take-offs is 2.4 worldwide and 3.5 for the Pacific Region. Accordingly, the accident rate will be much lower than the global rate, expecting 0.024 accidents per million take-offs.

AIR NAVIGATION REQUIREMENT - ATM

Services required:

- Air traffic control in Class A airspace, oceanic
- Reduced separation
- Surveillance control

Area to be covered: approximately 7,700,000 square kilometres

Operating hours: 24x7

Services offered:

- Area control service:
 - Longitudinal separation: 80 NM
 - Lateral: 50 NM with surveillance.
 - Vertical separation:
 - 1000 ft at levels that apply.
 - RVSM (1000 ft) at levels and for aircraft that apply
 - 2000 ft at the rest of the levels.
 - Application of the SLOP concept
 - CPDLC
 - Surveillance through satellite ADS-B
- Flight information service
- Alert service
- Communication failure contingency:

AIRCRAFT

- Satellite telephony communications
- International direct dialling (IDD)

Coordination between ACCs

- IDD communications (cellular/conventional).
- Surveillance system failure contingency:
 - Tracking of flight operations through commercial applications available in the market (Flightradar, flightaware).
 - Application of LOAs with adjacent FIRs/UIRs.
- ATCO dealing with contingencies

Application of the Air Traffic Management Manual of Ecuador
Chapter 15

- 15.2 Special procedures for in-flight contingencies over oceanic airspace
- Class “A” airspace FL 24.5 up to FL 600.
- Frequency
121.5 MHz emergencies

AIR NAVIGATION ENVIRONMENT - CNS

Services required:

- Aeronautical mobile communications
- Aeronautical fixed communications
- Air traffic surveillance (en-route overflights)

Area to be covered: approximately 7,700,000 square kilometres
Operating hours: 24x7

Systems to be implemented and basic characteristics:

- Communication equipment to support permanent FANS 1/A controller/pilot data link communications (CPDLC).
- Communication equipment and permanent channels for operational coordination with adjacent ACCs (6 ACCs).
- Complete and dedicated automated station for display of air traffic in the NO FIR, through satellite ADS-B position reports.

All these services will be integrated in the ATC station, and may be used through the ATC station in a coordinated manner.

Additional service characteristics:

- All communication and surveillance equipment will be redundant.
- Communication channel services will also be redundant and with an availability above 99.98%. Satellite ADS-B position reports will also have the same availability.
- ADS-C position reports will be used as a contingency element.

AIR NAVIGATION ENVIRONMENT - MET

Services required:

- TS SIGMET (tropical storms), ICE SIGMET (icing), TURB SIGMET (turbulence), VA SIGMET (volcanic ash) information.

Area to be covered: approximately 7,700,000 square kilometres
 Operating hours: 24x7

Systems to be implemented and basic characteristics:

MET services, in accordance with ICAO Doc 8896 – Manual on aeronautical meteorological practices, Twelfth edition, 2019

The following meteorological phenomena, for operations at cruise levels (regardless of altitude), are delivered via the SIGMET messages described below:

1.- Thunderstorms

- | | |
|---------------------------------------|-----------|
| • Obscured thunderstorm | OBSC TS |
| • Embedded thunderstorm | EMBD TS |
| • Frequent thunderstorm | FRQ TS |
| • Squall line thunderstorm | SQL TS |
| • Obscured thunderstorms with hail | OBSC TSGR |
| • Embedded thunderstorms with hail | EMBD TSGR |
| • Frequent thunderstorms with hail | FRQ TSGR |
| • Squall line thunderstorms with hail | SQL TSGR |

2.- Tropical cyclone

- Tropical cyclone with surface winds with a mean speed of 17 m/s (34 kt) or more, in a 10—minute period TC (+ name of the cyclone)

3.- Turbulence

- Severe turbulence SEV TURB

4.- Icing

- Severe icing SEV ICE
- Severe icing due to freezing rain SEV ICE (FZRA)

5.- Volcanic ash

- Volcanic ash VA (+ name of volcano, if known)

6.- Radioactive cloud

- Radioactive cloud RDOACT CLD

2.4 The Guayaquil Meteorological Watch Office issues SIGMET messages, and should transmit them to airborne aircraft through the associated air traffic service (ATS) units. At the initiative of the flight information centres (FIC), the airborne aircraft should receive SIGMET information affecting their routes up to a distance equivalent to two flight hours ahead of the position of the aircraft.

2.5 The following tools will be available as technological platform: WIFS, reception of meteorological satellite images, numerical modelling, and graphical SIGMET.

2.6 All services will be integrated in the ATC station and may be used through the ATC station in a coordinated manner.

AIR NAVIGATION ENVIRONMENT - AIS

Services required:

- Aeronautical information on the NO FIR and full details in the AIP
- NOTAMs related with the NO FIR, including the specifics required by IATA

Area to be covered: approximately 7,700,000 square kilometres

Operating hours: 24x7

Systems to be implemented and basic characteristics:

- Updated computer equipment with AIS applications

All services will be integrated in the ATC station and may be used through the ATC station in a coordinated manner.

ANALYSIS OF ADS-B IMPLEMENTATION

Surveillance services

Current equipment

2.7 Ecuador has seven non-cooperative (primary radar) and cooperative surveillance equipment, in the form of SSR and SSR Mode S (secondary radar), widely used by civil agencies for air traffic surveillance in TMA and en-route services, within the coverage of (ground) interrogating station(s).

Surveillance equipment under implementation

2.8 The Directorate General of Civil Aviation has approved the technical implementation of satellite ADS-B surveillance services by the provider AIREON, for use throughout its Guayaquil FIR. It also plans to deliver data from the NO FIR area, once Ecuador is assigned control over air traffic operations in said area by ICAO.

2.9 Figure 2 describes how satellite ADS-B can extend surveillance, mainly in oceanic and/or remote areas.

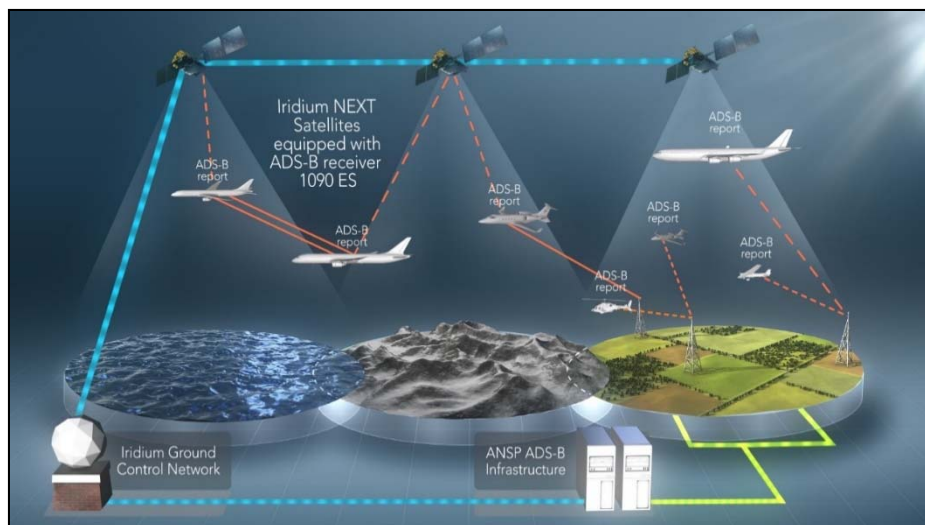


Figure 2: Basic components of satellite ADS-B

2.10 The satellite ADS-B system is operational since 4 April 2019, and air navigation providers such as Nav Canada and NATS are already using the system in the North Atlantic oceanic area.

2.11 The ICAO South American Regional Office conducted a feasibility and convenience study on the implementation of satellite ADS-B in the Region, with positive results. It revealed that implementation was not only feasible, but convenient for SAM States. Thus, Ecuador, in its analysis of ADS-B surveillance implementation, decided to incorporate the satellite ADS-B service to its capabilities.

2.12 Satellite ADS-B will be implemented in Ecuador to supplement the existing radar infrastructure, and to expand current surveillance capabilities to areas with limited or none radar coverage, such as its oceanic airspace, also allowing for coverage of the unassigned high seas airspace, which borders the Guayaquil FIR.

2.13 The implementation of AIREON Data Delivery Point in Ecuador is scheduled for December 2019, when transmission of satellite ADS-B information will begin and become operational for use by air traffic controllers in July 2020. Thus, Ecuador is in a position to take responsibility for air traffic control operations in the unassigned high seas airspace.

Air Traffic Flow Management - ATFM

2.14 Ecuador implemented the air traffic flow management (ATFM) service for the Guayaquil FIR on 26 May 2016, through AIC 009/16.

2.15 The Guayaquil FMP operates at the Guayaquil control centre. Runway capacity calculations for the Ecuadorian international airports (Quito, Guayaquil, Manta and Latacunga) are updated every six months, together with ATC sector capacity values for preparing runway capacity calculations.

Optimisation of Ecuadorian airspace

2.16 In order to support the implementation tasks defined in the Declaration of Bogota and, at the same time, provide a conceptual frame of reference the SAM Performance-Based Air Navigation Implementation Plan (SAM-PBIP), Ecuador implemented the following:

- a) UTA Guayaquil (SEFG) upper airspace PBN RNAV/5 routes: Of a total of 38 routes in the upper airspace, 24 are RNAV routes, representing 63% progress;
- b) Guayaquil FIR lower airspace PBN routes: Analysis and designation of IFPDs responsible for developing the study and design of the RNAV navigation chart in the lower airspace began on 15 April 2019; and
- c) PBN arrival (STAR) and departure (SID) routes.

Likewise, with the incorporation of the satellite ADS-B system, Ecuador will be able to meet airline requirements for more direct routes and use of user-preferred routes (UPR) in its airspace.

SEARCH AND RESCUE SERVICES (SAR)

Services required:

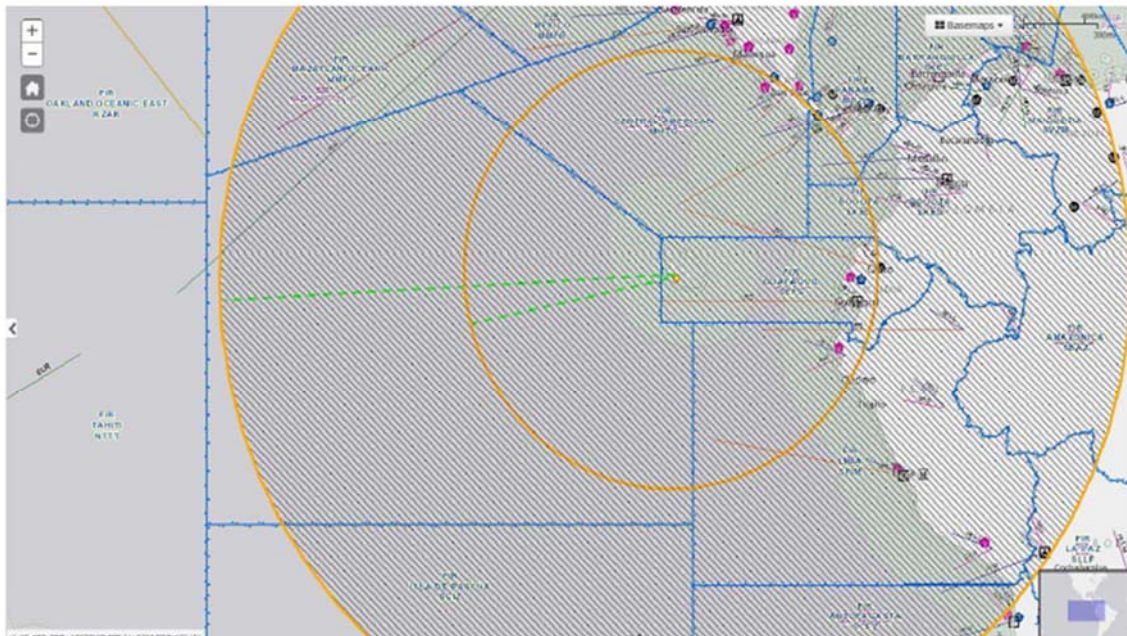
- Co-ordination for the search of the aircraft and its occupants in the NO FIR area.
- Co-ordination for the rescue of the aircraft and its occupants in the NO FIR area.

Area to be covered: approximately 7,700,000 square kilometres

Operating hours: 24x7



GALAPAGOS SEARCH AND RESCUE LONG RANGE OPERATIONS



Means available and basic characteristics:

2.17 In 2018, the Directorate of Air Navigation, through its SAR Management, implemented the Integrated Search and Rescue Coordination Centre called "RSC Galapagos" located in the Galapagos Islands.

2.18 Maritime SAR segment. The Ecuadorian Navy, through the National Directorate of Water Spaces (*Dirección Nacional de los Espacios Acuáticos - DIRNEA*) is responsible for the provision of search and rescue services (SAR) in the Ecuadorian maritime environment. The DIRNEA search and rescue area of responsibility in the oceanic area covers 3 segments:

- a) the territorial sea from the continental baseline to 200 miles;
- b) the 200-mile area adjacent to the Insular or Galapagos Region; and
- c) the middle band between the two regions.

The Ecuadorian maritime search and rescue region has a maritime SAR mission coordination centre called COGUAR associated to it, located at the Naval Base in the city of Guayaquil.

2.19 The Ecuadorian Navy provides maritime SAR services in the Galapagos Island region, through the Regional Directorate and Island Coast Guard, called "DIRGIN", which is located at the Naval Base in the Island of San Cristobal, for which it has the following resources:

- An integrated maritime search and rescue coordination centre, with SAR response systems.
- Communications within the area of responsibility.

SAR resources:

- Coast guard ships and motor boats.
- Aircraft: 1 CASA (CN235): 2 Beechcraft (BE-350) and 3 naval helicopters.

2.20 The integrated maritime search and rescue coordination centre will be responsible for the provision of aeronautical and maritime SAR services in the unassigned airspace, called NO-FIR, on the basis of the following statements:

- a. The Ecuadorian Navy has coast guard motor boats with capacity to navigate in search and rescue operations, up to 1200 NM in international waters (1200 NM to the West of the Galapagos Islands), for which they have systems and agreements for the coordination of search and rescue operations, both nationally and internationally.
- b. A CASA aircraft (CN 235) is available with SAR operational capacity of 11 hours of endurance, with the possibility of increasing this capacity, if necessary, with auxiliary fuel tanks for more extensive air-maritime exploration in the NO FIR area. This aircraft is permanently based in the San Cristobal Island.
- c. In order to support SAR operations in open waters, the COGUAR maritime RCC relies on several international agreements, including the International Convention on Maritime Search and Rescue.
- d. The International Maritime Organization (IMO) has search and rescue zones. Following the adoption of the SAR Convention in 1979, the Maritime Safety Committee divided the oceans of the Earth into 13 search and rescue zones, and the States concerned have a defined search and rescue zone for which they are responsible.

- e. International Convention on Maritime Search and Rescue / International Convention, Chapter 3 / Cooperation.

2.21 Coordination with aeronautical services

- a. The SAR integrated centre will ensure the closest possible coordination between maritime and aeronautical services, so that they can provide the most effective and positive search and rescue services in their respective search and rescue regions.
- b. To the extent possible, the parties involved will ensure that rescue units established for maritime purposes, and those established for aeronautical purposes, use standard procedures.
- c. The implementation of the Aeronautical-Maritime Integrated SAR Centre in the Insular Region will provide both the General Directorate of Civil Aviation and the National Directorate of Water Spaces with a joint SAR unit, capable of directly coordinating the required SAR response to emergencies involving aircraft flying over unassigned airspace (NO-FIR) and on the oceanic air routes that cross the Guayaquil FIR / UTA, and on those subsequently established in the indicated area.

3. Conclusions

3.1 Ecuador is constantly investing in CNS/ATM, ATFM and search and rescue capabilities to ensure quality and safety in the airspace under its responsibility, as shown in this working paper.

3.2 With the implementation of satellite ADS-B, Ecuador will provide airlines with modern EASA-certified air traffic surveillance services, in line with user requirements, offering the highest level of safety in airspace controlled by Ecuador, and a timely search and rescue (SAR) response.

4. Suggested Action

4.1 The Meeting is invited to:

- a) Take note of the information provided in this working paper;
- b) Analyse and acknowledge the technical capability of Ecuador to be assigned the responsibility for the unassigned FIR;
- c) Accept the development of new oceanic connectivity routes; and
- d) Analyse and acknowledge the SAR capacity of Ecuador from its insular territory in the Galapagos Archipelago.